

SCIRTES TIBIALIS, GUER., (Coleoptera-Dasyllidæ),
With Observations on its Life History.*

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Scirtes tibialis, Guer., belongs to the *Dasyllidæ*, a comparatively little known family of small, inconspicuous beetles which have not been extensively studied. The adults are technically described, but few of the life histories have been worked out, despite some very interesting larval forms represented in the family. Of these beetles, some (grouped together as the *Cyphonides*, (13), from the name of the genus *Cyphon*) have aquatic larvæ, and these are remarkable in possessing long, many-jointed antennæ. *Scirtes* is of this type.

A search into the literature revealed nothing on *Scirtes tibialis*, except the description of the adult (4), (5), (1), and only a few scattered notes on the genus, with but one paper dealing with the larva (9), and that the species *Scirtes championi*. Both *Helodes* and *Cyphon* have been the subject of a number of studies, mainly in Europe, and most of the aid relative to the larvæ of *Scirtes* was obtained from the papers (2, 3, 9, 10, 11, 12) on these related genera.

OCCURRENCE AND DISTRIBUTION.

Although aquatic, the larva is not an open-water swimmer. It has a distribution restricted to that of the duckweed, *Lemna minor*, its one food plant, which grows commonly in solid areas often of some considerable extent, throughout the summer, in quiet shallow waters of bays along the shores of small lakes, and in suitable permanent ponds, large or small. The material used in this study was obtained principally from a pond northwest of Madison, Wisconsin, and also from such bays along the shores of Lake Mendota and Monona. The larvæ are usually found resting or feeding on the lower surfaces of *Lemna* leaves.

When crossing small spaces of open water, the larva moves (never more than a few inches at a time) usually with ventral side uppermost, just beneath the surface film. It may also be dorsal side uppermost, especially when swimming down away from the surface. Its motion is a characteristic wriggling one,

* Contribution from the Zoological Laboratory of the University of Wisconsin.

which is a combination of very rapid leg movements and rapid jerky bendings of the body from side to side. The body movement is the effective factor in the locomotion. Sometimes it suddenly stops in its movement and rests just beneath the surface film apparently as well as beneath leaves. The locomotion of the younger instars differs somewhat, but this is one of the phases that can not be elaborated here.

The beetle itself is never aquatic, but is commonly found on grasses and other plants along shores and on the exposed portions of aquatic vegetation, of waters suitable for the larva. The imago is perfectly capable of flying, but is also a remarkably powerful jumper, possessing enormously swollen hind femora. Most of its motion, within its usual habitat, is by jumping.

LIFE HISTORY.

Egg.

The eggs were not found in nature, but many were laid under laboratory conditions by both reared and captured beetles. Whether eggs are normally laid submerged could unfortunately not be determined. I never saw a beetle enter the water to lay eggs, nor deposit them into water, although some dishes were favorably constructed for such procedure. Judging from the immediate water requirements of the young larva, however, it seems an entirely artificial and abnormal condition that all eggs secured were laid by beetles on dry objects, directly on the glass surface or on bits of leaves in small vials (without water) in which many of the beetles were isolated for observation.

Eggs are laid in small, irregular masses, which are stuck to the surface. Of the eggs studied, the first mass was laid during the night of July 5 and hatched July 16, making an egg period of 11 days. The time of oviposition of six other masses was known, but in three of these all the eggs died because of mold. The periods of the remaining ones were $9\frac{1}{2}$, $10\frac{1}{2}$ and 11 days. The eggs of a single mass all hatch within a space of several hours. The egg period is hence $9\frac{1}{2}$ to 11 days.

Larva.

The only young larvæ obtained were from the above mentioned egg masses in the laboratory, and were numbered in groups correspondingly. Records of all of their ecdyses were

made and the stadia lengths were noted (in a series of tables) in days, but also in half days and shorter intervals where possible. The average length of the stadia for all the individuals in a group are given in the following table:

GROUP	No. of individuals in group at begin'ng	LENGTH OF STADIA IN NUMBER OF DAYS						
		1st Stadium	2nd Stadium	3rd Stadium	4th Stadium	5th Stadium	6th Stadium	7th Stadium
No. 1.....	23	3	4	4	8	9	3	8
No. 4.....	19	2.56	6	6.2	6	6.16
No. 5.....	15	2.5	6	5.34	6.7	7.7	7
No. 7.....	12	2.25

There is some apparent regularity in these stadia lengths, but not enough for drawing exact conclusions. Especially is this true of the latter ones because of the many fatalities caused largely by molds, that occurred in an increasing rate. As a result these latter stadia are represented by only a few individuals. In group 1 unfortunately all the larvæ except one were killed by mold early in the second stadium, sharing the fate of groups 2 and 3; but this one survivor lived through its seventh stadium and died in its eighth. Thus of group 7, all the larvæ died before they had completed the second stadium, and of group 4, before they had completed the 6th stadium. Observations terminated in the middle of September. Since work could not be continued during fall and winter, further data of ecdyses and growth and the exact manner of over-wintering, could not be ascertained. An unsuccessful effort was made to determine the winter condition of the larvæ when I resumed work in March.

The first larva found in Spring (1918) was on May 4 at which time just a few new Lemna leaves had come to the surface, (having developed from bulblets, which overwinter at the bottom). Though the food supply was just as meagre May 11, twelve larvæ were secured, and they were becoming increasingly more abundant in the upper water. This represents then the time of resumption of growth and activity. The seventh instar, the last reared the preceding August, was only three-tenths as long as the average full grown larva. Some of the larvæ obtained in May were no larger, but they varied from

2 to 3 mm. in length. The disparity in size is accounted for by earlier or later hatching the previous summer, and because of this fact, and since no individual life history could be traced, no significant comparisons as to size between these larvæ, or with that of the preceding autumn, can be made.

It can be stated that the larvæ have a comparatively slow growth, a large number of ecdyses, that they overwinter at the bottom of the water, and must pass through considerable of their growth in late spring.

Old larvæ were obtained (in 1917) from June 17, when this work was begun, to July 22. The distribution over this period and relative abundance of maximum size old larvæ shows that in this locality the mean date for their full growth is during the first week in July.

Pupa.

The pupa is short-lived. It was not found in nature, but many old larvæ pupated in the laboratory, and, although there was a rather high death rate, due to molds, a number completed their life history. Out of 25 pupæ, the time of pupation of 4 was not secured, and 12 died before emerging as imagoes. The records of the other 9 show an average pupal period of about 3 days.

Adult.

The beetle was first caught on July 4, but only three were then secured. This date corresponds pretty well with that of the first emergence of the beetle in the laboratory, July 6. In nature the beetles became increasingly more abundant up to the latter part of the month, after which there was a rapid decline until the last week in August when no more were captured.

The life stages obviously overlap during early and middle summer, when at some favorable time old larvæ, pupæ, adults, eggs, and even young, new larvæ may exist simultaneously. The period for each life stage is pretty well marked off though with a maximum point of abundance for each.

A summary of the life history (which seems reasonable even from the incomplete results) shows an egg period of about ten days, a larval life of about eleven months, a pupal period of three days, and an imaginal existence of possibly a week or two,

although the last is a mere estimate from a few laboratory cases, and it must be said that the laboratory conditions for the adult were unavoidably very artificial. There is one generation a year.

DESCRIPTION OF STAGES.

The Egg (Fig. 1).

The eggs are ellipsoidal in shape, smooth, of cream-white color, and uniform size, measuring .37 mm. in length and .25 mm. in greatest thickness. Eggs are laid in irregular masses. The embryo in the latter part of the stage is clearly visible.

The Larva, First Instar (Fig. 2).

The first instar is very small, the specimen figured being .69 mm. in length (exclusive of antennæ) and .19 mm. in greatest width. Body elongate, tapering distinctly and continuously caudad, widest at pro- and meso-thorax. Translucent whitish color. Head narrower than thorax, slightly broader than long, widest at eyes. Prothorax longest segment of the body. Eighth abdominal segment longer than others, as long as broad, tapering caudad, and complete (as are preceding seven), but its sternum only half as long as its tergum; ninth segment, represented by sternum only, equal in length to sternum of eighth. Each eye consists of a larger mass of ocelli, with a smaller mass just behind it and nearly confluent with it. Antennæ setaceous, half as long as body, and of 7 segments. Legs similar; coxa short; trochanter triangular; femur and tibia of nearly equal length; tarsus of one segment, and in form of a long single claw. Of the setæ, distributed as shown in Fig. 1, only the very long ones extending posteriorly from the eighth abdominal segment, need be noted here, as a distinguishing character for the instar.

Subsequent Instars.

Succeeding instars do not differ markedly from the first. There is more difference in general appearance between the first and second instars (compare Figs. 2 and 3) than between any two subsequent, successive ones. The long caudal setæ of the first instar are replaced by short setæ after the first molt. Growth in size is very slow. After the second molt the body begins to taper somewhat more cephalad, the greatest width being in the metathorax. A slight yellow-tan color is apparent as early as the third instar; it becomes darker in succeeding ones, and ultimately brown. The two adjacent masses of ocelli soon fuse into one rounded eye. The coxa, even in the second instar is longer than in the first, and in later instars is comparatively much longer.

The most marked change is that of the number and proportionate size of the antennal segments, which increase in a graduated way at successive ecdyses. Examination of available specimens showed a constant number of segments (barring obvious abnormalities) as follows: first instar, 7 segments; second instar, 13 segments; third instar, 21 segments; fourth instar, 29 segments; fifth instar, 35 or 37 segments.

Determination of what stage a larva was in depended upon counts of antennal segments. Lack of sufficient material precluded study of instars directly following the above. Whether there is a similarly graduated increase and constancy for all instars cannot consequently be stated. A continued increase in number (without corresponding large increase in comparative length of the antennæ) seems certain though, for in the full grown larva, a big total of 120 to 125 segments exist. This is a striking feature, and one which does not correspond with the condition in larvæ of *Helodes* and *Cyphon*, (11).

Last Instar (Fig. 4).

The average full grown larva has a length of 7 mm. The specimen figured, with a length of 7.33 mm., was of maximum size. The body generally is as described for earlier instars, but is more flattened dorso-ventrally. Its shape can be characterized in short as that of the silver fish, *Lepisma* sp., a similarity that is true also of the antennæ. Color a dark, uniform brown. Head normally deflexed. Antennæ setaceous, very long and slender, three-fourths as long as body, of 120-125 segments; segments 1 and 2 much longer than any of those following. Leg has long, heavy coxa.

Pupa (Fig. 5).

The pupa is elongate-rounded, about 4.5 mm. in length, and of cream white color. It is attached by its anterior end to the lower surface of a *Lemna* leaf, and hangs freely. The last larval skin may or may not remain attached to the pupa; if it remains it may be for either a short period or even beyond the emergence of the imago.

Adult (Fig. 6).

The adult (length 3 to 3.5 mm.) was originally described by Guerin (4). Although his work was not available, the descriptions of Horn (5), and Blatchley (1), obviate the need of technical description here. The most characteristic features which are easily noted in this beetle are its very broadly oval shape, its short, much deflexed head, and its greatly swollen hind femora.

Although the color of very many of the specimens of beetles is, as described, "uniform piceous or nearly black, moderately shining," (1), of a considerable number of others it is a uniform dull, dark brown. The beetle is "sparsely pubescent," but the brown ones are relatively more pubescent than the black. The brown ones as a group are also larger, having all about the maximum length of 3.5 mm., while the black are on the whole 3 mm. in length. While Horn (5), says that the claw on the tarsus is simple, in all beetles examined in this study, the tarsal claw was double.

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EXPLANATION OF PLATE XXXV.

(Figures outlined with camera lucida).

- Fig. 1. Egg, length .37 mm.
- Fig. 2. Larva, first instar, dorsal view, length .69 mm.
- Fig. 3. Larva, second instar, dorsal view, length .74 mm.
- Fig. 4. Larva, final instar, dorsal view, length 7.33 mm.
- Fig. 5. Pupa (P), attached to Lemna leaf. Last larval skin (L) still attached to pupa. Leaf tilted upward to show under surface completely.
- Fig. 6. Adult beetle, dorsal view, length 3.6 mm. Head much deflexed so that it is not seen from this aspect. Pubescence indicated by short hair lines.